

U.S. ARMY NATICK SOLDIER SYSTEMS CENTER

BROAD AGENCY ANNOUNCEMENT (BAA)

Solicitation Number "01 - 03 Natick BAA"

*Effective from 2 April 2001 - 31 March 2003
(Revised Version as of 7/24/01 - added topic #2 in "B" of Section VI)*

TABLE OF CONTENTS

	PAGE(S)
SECTION I	
Introduction	1
SECTION II	
Concept Papers and Proposals	2-7
SECTION III	
Additional Information to be Submitted with Proposals	8-9
SECTION IV	
Evaluation Process	10-14
SECTION V	
Safety and Manprint Requirements	15-16
SECTION VI	
Scientific and Technical Areas of Interest	17-53
A. Combat Ration Research and Development	17-20
B. Military Operations in Urban Terrain	20-22
1. Military Operations in Urban and Restricted Domains	20-21
2. Unmanned Aerial and Ground Vehicles (UAV/UGVs) for Urban Operations	21-22
C. Food Service/Field Service	22-26
1. Combat Food Service Equipment for Individual and Group Feeding	22-24
2. Unit/Organization Equipment	24-26
D. Warrior Systems Technologies	27-44
1. Ballistic Protection for Individuals	27-28
2. Individual Laser Eye Protection	28-29
3. Chemical/Biological Protection for Individuals	29-31

4. Flame and Thermal Protection for the Individual Soldier	31-32
5. Countersurveillance	32-34
6. Body Worn Smart Materials	34-35
7. Head Mounted, Hand Held, Body-worn Systems and Smart-lightweight Electronic Components/Modules for Information Management	35-36
8. Biomechanics	36-37
9. Materials Nanotechnology	38
10. Wearable Solar Cells	39-40
11. Anthropometry	40-41
12. Advanced Protection and Integration Technologies and Systems	41-42
13. Warrior Performance	42-44
E. Tentage, Fabric Structures and Rigid Wall Shelters	44-47
F. Airdrop - Advanced Personnel and Cargo Airdrop Systems	47-48
G. Textile Technologies	48-49
H. Modeling and Simulation	49-53
1. Individual and Small Unit Performance and Survivability	49-51
2. Airdrop System Combat Worth Simulation	51-52
3. Analytic 3D Soldier System Prototyping and Testing	52-53
I. Biosystems Technology Program Research and Development	53-54

SECTION I

INTRODUCTION

The mission of the U.S. Army Natick Soldier Systems Center (NSC) is to assure maximum survivability, supportability, sustainability and combat-effectiveness of individual soldiers and crews on the battlefield under world-wide environmental extremes.

Our goal is to provide the American soldier the best equipment for the best price through research, development and engineering in the areas of combat ration research, food service/field service, warrior systems technologies, tentage, fabric structures, rigid wall shelters, airdrop, textile technologies, modeling/simulation, biosystems technology, and military operations in urban/restricted domains. We are deeply committed to making our soldiers, and all service members, the best clothed, equipped, sheltered, and fed in the world.

This Broad Agency Announcement (BAA) is intended to fulfill requirements for scientific study and experimentation directed toward advancing state-of-the-art technologies, and/or increasing knowledge and understanding as a means of eliminating current technology barriers. This BAA DOES NOT focus on specific systems or hardware solutions. This BAA identifies NSC research/exploratory development areas of interest, and provides prospective offerors information on the preparation of proposals, along with proposal evaluation factors. The government may award contracts, grants, cooperative agreements or other transactions under this BAA.

Please note that, typically, research resulting from work executed under this BAA leads to an additional requirement for services being provided by the applicable contractor in support of operational experiments to evaluate the measures of merit and performance enhancement capability to the warfighters. However, it is not possible at the time of release of this announcement, or at the time of contract award, to accurately anticipate if these services will be required, nor is it possible to anticipate the level of effort required. In addition, the technology explored under this BAA typically has application across the various branches of the Department of Defense (DoD). In order to satisfy the unique needs of these different branches, and to ensure a proper job is done in the evaluation of the applicable technology, contract modifications which add new Contract Line Item Numbers (CLINs), and/or expand on current CLINs, for services/supplies providing for flexibility in technology assessment (with technology transition the ultimate goal) may be executed. In the event that this is required, it shall be considered to be within the scope of this BAA and the resulting contract, and therefore will have met the requirements of the Federal Acquisition Regulation (FAR)/DoD FAR (DFARS) and the Competition in Contracting Act. The benefit of this flexibility to the government, and ultimately the taxpayer, is a significant increase in the research and development (R&D) return on investment. The flexibility to have multiple users (branches of the military) in the technology evaluation cycle is absolutely critical and allows systems and technologies to be developed in a manner that has broader DoD market applications. These can then be modularly reconfigured to meet goals and objectives for all DoD services.

SECTION II

CONCEPT PAPERS AND PROPOSALS

1. WHO MAY SUBMIT

a. The NSC will consider concept papers and proposals based on this BAA from the following organizations and firms interested in conducting scientific research: colleges and universities, nonprofit research institutes, and commercial firms (including small businesses, HUBZone small businesses, minority businesses, and women owned businesses). Offerors are cautioned that only a duly appointed Contracting Officer acting within the scope and limits of his/her authority may obligate the government to the expenditure of funds. Proposals from government facilities and organizations WILL NOT be considered under this program announcement.

b. Small Businesses (SBs), Small Disadvantaged Businesses (SDBs), HUBZone Small Businesses, Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs): Although no portion of this BAA has been set aside for SBs, SDBs, HUBZones, HBCUs, or MIs, their participation is highly encouraged. For any topic areas (see Section VI) where sufficient quality proposals are received that demonstrate a set-aside would be appropriate, NSC will consider doing so and modifying this BAA accordingly. Therefore, all named business types are encouraged to submit proposals under any topic which they feel they are highly qualified to perform. The applicable North American Industry Classification System (NAICS) code for the majority of work submitted under this BAA will be 541710 with a size standard of 500 employees.

2. WHEN TO SUBMIT

a. This BAA shall remain in effect until 31 March 2003 unless superseded, extended or canceled. Concept papers will be accepted up until the close of business on 28 February 2003. Proposals may be submitted at any time after the concept paper has been approved and up until the BAA closing date of 31 March 2003. Awards against this BAA may be made up until 30 June 2003.

b. The contractor agrees that if their offer is accepted by the government within ninety (90) calendar days from the date of their proposal, to furnish any or all items upon which prices are offered at the price set opposite each item, delivered at the designated point(s), within the time specified in the schedule. At times, the government may contact a contractor after the ninety (90) day period about a proposal they would like to bring to award. This will occur when a shortage of funds exists during the initial ninety (90) day period. If this does occur, the contractor reserves the right to except or decline the offer and may also submit a revised proposal with any necessary price/schedule changes, though the technical merit must remain the same.

3. WHERE TO SUBMIT

Concept papers, proposals and inquiries shall be submitted to the address indicated under each scientific and technical area of interest as cited in Section VI herein. Facsimile submission is normally not an authorized means for the delivery of such documents. The contractor shall receive prior approval from applicable point of contact (POC) for facsimile submissions.

4. BAA PROCESS

In an effort to minimize proposal preparation costs, this BAA will utilize a two step process. The first step will be the submission of a concept paper. This step will preclude unwarranted effort on the part of an offeror whose proposed technology/capability or product is not of interest to the government. Those concept papers found to be consistent with the intent of the BAA and which are of interest to the government will be invited to submit a proposal (step two). Failure to follow this two step process may preclude any chance for an award.

Communication with the technical POCs identified in Section VI. Scientific and Technical Areas Of Interest (as well as the POCs listed for Safety and MANPRINT) is essential in tailoring responses to the specific needs of NSC. This preliminary communication is especially important because once the formal proposal is accepted by the technical POC and submitted to the NSC's contracting office, no further communication between the proposed contractor and the government technical POC is allowed.

Requests for conference or symposium support, consultant services, and/or training support will not be considered under this announcement. Only concepts for research/exploratory development will be considered.

Contractors shall not submit a proposal until the concept paper has been reviewed by selected government personnel and the contractor has been invited to submit a formal proposal by government personnel. Failure to follow this process will likely preclude further consideration by the government.

a. STEP ONE: If the offeror has a novel research approach within an area of interest covered by this BAA, a BAA concept paper should be prepared. Concept papers should be submitted electronically to the technical POCs listed in each area of interest in Section VI. Concept papers may not exceed 5 single-sided 8 ½ x 11 inch typed pages (including charts, graphs, photographs, etc.) and shall include the following:

1. A brief technical explanation of the proposed effort that addresses the major research thrust, the research goals, and military relevancy.
2. A brief "management" description outlining key personnel and experience.
3. Any past performance the contractor has had with similar research efforts.
4. An estimated cost/price and performance schedule for the work.

Once an offeror has been invited to submit a formal proposal, the following process must be adhered to by the offeror.

b. STEP TWO: Informal exchanges should be held with the technical POC listed under each topical area noted in Section VI herein on any proposed research BEFORE the submission of a formal proposal since the BAA is written in such broad terms to cover a wide variety of technical areas.

The offeror's technical, management, cost/price, past performance, subcontracting (if applicable), and company certification sections of the proposal shall be submitted in severable sections as set forth below. All information pertaining to each section shall be confined to the appropriate part. The sections shall be as brief as possible, consistent with complete submission. Pages should not exceed 8-1/2 inches in width and 11 inches in length; however, fold-out pages depicting such items as sketches, etc., may be used. The proposal shall be evaluated in accordance with the process described in Section IV herein.

PART I - Technical Section - automated and/or one (1) original

PART II - Management Section - automated and/or one (1) original

PART III - Cost/Price Section - automated and/or one (1) original

PART IV - Past Performance Section - automated and/or one (1) original

PART V - Subcontracting (if applicable) - automated and/or one (1) original

PART VI - Contractor Representations and Certifications - automated and/or one (1) original

(1) **Part I - Technical Section:** Offeror is responsible for including sufficient details, without reference to cost/price, to permit a complete and accurate evaluation of the proposal from a strictly technical standpoint. The following information shall be included:

(a) Specific BAA topic area by number and title which the proposal is being submitted under.

(b) A summary of the objective/purpose of proposed research - what scientific "problem" do you intend to resolve, advance the state-of -the-art with respect to, or increase the understanding of.

(c) Identification of product(s) or process(es) which you anticipate will result from this effort. Product(s) may simply be technical data, reports on the feasibility of novel concepts, product samples, etc. Also address any MANPRINT requirements or state that no such requirements exist. For specific details and guidance on MANPRINT and safety requirements see Section V herein.

(d) Identification of any potential military and/or civilian applications of the product(s) which may be developed if the work performed under the proposed BAA contract is followed through on, following completion of the proposed contract.

(e) An assessment of the probability for project success.

(f) An explanation of the planned approach, techniques, and/or processes to be used in this effort.

(g) Rationale for the proposed methodology. What, if any, innovative ideas/techniques will be tried?
(h) What innovative ideas/techniques, if any, will be tried?

(h) Any planned interactions with NSC (to include a request for a post-award conference if the contractor so desires) required during the performance of proposed contract.

(i) Any planned collaborative arrangements with other parties (including subcontractors) for the effort. If offeror is an academic institution, details of planned interactions with industry (if applicable), and letters from the industries in which they commit themselves to support the effort, should be provided.

(j) A list of the deliverables (technical data, processes, publications, samples, etc.) that will result from the effort plus demonstration of a clear pathway from the research to the intended deliverables.

(k) A schedule containing milestones for the performance of the proposed effort.

(2) **Part II - Management Section:** The management section of the proposal shall include the following:

(a) Resumes (or some portion of such) of technical personnel detailing education, experience, and technical expertise proposed for this effort and the percentage of time expected to be devoted to this project.

(b) Organization of the offeror's firm.

(c) Facilities and equipment available for the proposed effort.

(d) Project management systems and controls to be utilized by the contractor.

(3) **Part III - Cost/Price Section:**

(a) The offeror is required to submit either certified cost and pricing data (for proposals greater than \$500,000) or information other than cost or pricing data (see FAR Subpart 15.403-5). Certified cost and pricing data shall be submitted in accordance with Table 15-2 in FAR Subpart 15.408. Sufficient cost/price information is required to allow the government to make a determination of fair and reasonable price and cost realism. The information shall be submitted at the level of detail described below and may be submitted in the offeror's own format. Examples of cost/price data are as follows:

- o Materials, including raw materials and purchased parts;
- o Labor with engineering, manufacturing and service labor shown as separate elements; each labor category should cite hours of labor, hourly rate of pay, and total labor cost;

- o Other direct cost, with supporting documentation;
- o Costs for contractors with whom the lead contractor is teaming;
- o Overhead cost and rates;
- o Facilities capital cost of money (note: if facilities capital cost of money is requested, the offeror shall submit a DD Form 1861);
- o Consultant costs, if applicable, shall include the names of the consultants, resumes with qualifications and experience, purpose on the project, number of days to be employed, and rates of pay per day;
- o Profit or fee (if applicable).

(b) Cost/Price Realism: A proposal is presumed to represent an offeror's best efforts to respond to the solicitation. Any inconsistency, whether real or apparent, between promised performance and cost/price, should be explained in the proposal. For example, if the intended use of new and innovative production techniques is the basis for an abnormally low estimate, the nature of these techniques and their impact on cost/price should be explained; or, if a corporate policy decision has been made to absorb a portion of the estimated cost, that should be stated in the proposal. Any significant inconsistency, if unexplained, raises a fundamental issue of the offeror's understanding of the nature and scope of work required and of its financial ability to perform the contract, and may be grounds for rejection of the proposal. The contractor shall supply the government with sufficient information to allow the government to assess the reasonableness of the contractor's costs/prices.

(4) Part IV - Past Performance Section:

(a) Information should be submitted for all proposed first-tier subcontractors with whom the offeror is teaming, as well as the offeror.

(b) Offeror should submit past performance information on any contracts (as a prime or subcontractor) they worked on during the previous three (3) years which are relevant to the efforts required by this solicitation. In addition, any and all contracts terminated in whole or part during the previous five (5) years, to include those currently in the process of such termination, are considered relevant and the offeror shall provide past performance information for those contracts. The following information should be included:

- o Role as prime or subcontractor
- o If from past government contract, the contracting activity, address, and the contracting officer's name, telephone/facsimile numbers and email address
- o Contract type
- o Awarded cost/price
- o Final, or projected final cost/price
- o Original delivery schedule
- o Final, or projected final, delivery schedule

(c) For each of the contracts described in the past performance section of the offeror's proposal, a description of the objectives achieved, detailing how the effort is similar to the requirements of this solicitation, shall be included. For any contracts which did not/do not meet the original requirements with regard to either original cost/price, schedule, or technical performance, the offeror should provide a brief explanation of the reason(s) for such shortcomings and any demonstrated corrective actions taken to avoid recurrence. For any terminated contracts, the offeror shall indicate the termination type and reasons.

(5) Part V - Subcontracting Plans (if applicable)

Once proposals are accepted by the technical POCs and submitted to the Contracting Office for evaluation, the Contracting Officer may decide a subcontracting plan from the offeror is required. This will be dependant upon the contract value and whether or not subcontracting possibilities exist. This requirement shall NEVER apply to small business concerns.

Should a subcontracting plan be required, the offeror shall prepare it in accordance with FAR clause 52.219-9, and DFARs clause 252.219-7003 (also, for reference, see Appendix CC, AFARS Part 19.7). During the time period this BAA is in effect the small, small disadvantaged, HUBZone, and woman-owned subcontracting goal percentages will vary. Therefore, should a subcontracting plan be required the Contracting Officer will establish goals for the offereor at the time one is requested.

As submitted under this BAA, subcontracting plans will be reviewed for adherence to regulations cited in FAR Part 19 and its supplements and not necessarily for evaluation as a specific evaluation criteria. However, an offeror's refusal to submit a subcontracting plan is grounds for the government to not negotiate award of the offeror's BAA proposal.

(6) Part VI - Contractor Representations and Certifications

Provided as an attachment to this Broad Agency Announcement is a document which lists FAR and DFAR provisions and clauses which need to be filled out by the contractor and returned with the proposal. Note that not all provisions/clauses will be applicable to every company so if one does not apply the offeror shall mark as such with an N/A. Also note that the applicable NAICS code for the majority of work submitted under this BAA will be 541710 with a size standard of 500 employees. If the offeror feels a different NAICS applies then provision 52.219-1 may be altered by the offeror accordingly.

SECTION III

ADDITIONAL INFORMATION TO BE SUBMITTED WITH PROPOSALS

1. **GOVERNMENT FURNISHED PROPERTY (GFP):** Government-furnished property, as defined in FAR Part 45, may be available for contractor use during the performance of a given contract awarded against this BAA.

a. The offeror should clearly request in its proposal what, if anything, it desires as GFP for the given project. It is recommended that a section in the technical or management proposal be set aside to summarize the GFP requirements.

b. The offeror may request, for incorporation in the contract, a GFP delivery schedule NOT based specifically on the date of contract award.

c. Any property furnished to, and accepted by, the government under a resultant contract, and subsequently returned to the contractor for any reason, shall be regarded as government furnished property.

d. Any facilities, including rooms, desks, etc., to be provided to a contractor by the government for the performance of any portion of a contract, is considered to be GFP, and if needed should be specifically requested for the applicable time frames in the offeror's proposal.

2. **TYPE OF CONTRACT:** Contract type may vary according to the degree and timing of the responsibility assumed by the contractor for the cost of performance and the amount and nature of the profit incentive offered to the contractor for achieving or exceeding specific standards and goals. See FAR Subpart 16.101(a). Offerors shall identify the type(s) of contract (FAR Part 16) they feel is(are) best suited to the proposed effort. An offeror's suggestion regarding suitable contract type does not obligate the government to employ the suggested contract type. The selection of the contract type is subject to negotiation.

3. **PREPARATION COSTS:** It must be clearly understood that the receipt and review of concept papers and proposals as described in this BAA by the government is entirely for the purpose of technical evaluation and in no way constitutes an agreement to enter into contractual or other relationships. It must be further understood that the submission of such documents is voluntary and must be done solely at the offeror's expense. The government will in no way be held liable for, nor reimburse, an offeror for any expenses (direct or indirect) incurred in the process of formulating or submitting such documents.

4. **AVAILABILITY OF FUNDS:** It must be clearly understood that, as of the date of release of this BAA, there are no funds committed for any project. Until such time as funds are released to the Contracting Officer, no contract can, or will, be made for an otherwise acceptable proposal.

5. All FAR information/references, plus other related acquisition information may be found on the internet at any of the following addresses:

<http://www.arnet.gov/far/>

<http://farsite.hill.af.mil/VFFARa.htm>

<http://web2.deskbook.osd.mil/default.asp>

6. **CENTRAL CONTRACTOR REGISTRATION (CCR):** By submission of an offer, the offeror acknowledges the requirement that prospective awardees **MUST** be registered in the CCR database prior to award, during performance, and through final payment of any contract resulting from this solicitation. Lack of registration in the CCR database shall make an offeror ineligible for award. Offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation. To remain registered in the CCR database after the initial registration, the contractor is required to confirm on an annual basis that its information in the CCR database is accurate and complete. For all CCR information (including any exemptions) go to <http://www.ccr2000.com/> or phone 1-888-227-2423 (616-961-4725 if outside USA).

7. **PAYMENT BY ELECTRONIC FUNDS TRANSFER:** All payments by the government under contracts awarded from this BAA shall be made by electronic funds transfer (EFT) or the government VISA purchase card.

SECTION IV

EVALUATION PROCESS

1. **CONCEPT PAPERS:** Concept papers will be evaluated by technical/scientific personnel that are knowledgeable within the particular topical area/specific interest area to determine if the paper presented is consistent with the intent of the BAA and is of interest to the government. Concept papers will be evaluated on the scientific/technical merit, the management approach, the importance to agency programs, and the proposed cost/price. The highest evaluated concept papers will show considerable potential to develop into a proposal that will be highly qualified in these evaluation criteria and will have a high likelihood for an award. Concept papers will be evaluated within ninety (90) days of receipt.

2. **PROPOSALS:**

a. Proposals submitted in response to this solicitation will be given a scientific/peer review evaluation by NSC technical personnel in accordance with below evaluation criteria within ninety (90) days after receipt. Each proposal will be evaluated based on the merit and relevance of the specific proposal as it relates to NSC program requirements/needs, rather than against other proposals. Once a proposal has been submitted by the technical POC to the contracting office the contractor is to **HAVE NO FURTHER CONTACT** with the technical POC until the time a contract award exists. Inquiries regarding status of the evaluation may be addressed to the administrative POC indicated under each scientific and technical area.

b. Offerors whose proposals are considered not to have sufficient merit, which are not relevant to an Army need, or which are in areas for which funds are not expected to be available, will be notified as soon as possible after completion of evaluation that their proposal will not be further considered for a contract award.

c. For those proposals that are acceptable, notification will be made within ninety (90) days after receipt of proposal. The offeror will also be notified as to if and when funding is expected to be available for the project. The offeror is cautioned that the availability of funds as of the date of such notice is no guarantee that funds will be available at any given later date.

3. **BASIS FOR AWARD:** Offers will be selected based upon the outcome of proposal evaluation in accordance with the evaluation criteria cited below, plus the availability and source of funds. Not all highly rated proposals will result in a contract award. The government may elect not to award a contract for every highly rated proposal for each topical area/specific interest area. The government may award more than one contract in a given topical area/specific interest area, or the government may not award a contract at all in a given topical area/specific interest area.

4. **EVALUATION CRITERIA:**

a. Technical Area:

(1) Technical Merit: The offer will be evaluated on the relevance of the proposed effort in response to the topical areas/specific interest areas and the overall technical feasibility of the technology, capability, the product and/or the technology proposed.

(2) Technology Advancement/Warfighting Capability: The offer will be evaluated on the potential to increase the combat effectiveness of the Army and the potential for exploiting a capability not likely to be executed elsewhere.

(3) Safety and MANPRINT Requirements (when applicable): The offer will be evaluated to assure that it has properly addressed safety/MANPRINT requirements (see section V herein) by including the following information:

(a) The offeror's understanding of safety/MANPRINT and how it applies to the proposed offer.

(b) What methods/techniques will be used to ensure that safety/MANPRINT will be incorporated into the program so as to ensure that the items/product delivered to the government are safe and effective for use by personnel

(c) The qualification/knowledge of the individual responsible for the offer's safety/MANPRINT requirements.

b. Management Area:

(1) The proposal will be evaluated on the quality of the personnel, equipment, facilities, project management systems, controls and the milestone schedule being proposed.

(2) The proposed contractor will be evaluated on the overall organization of the firm as well as the overall management plan.

c. Cost/Price Area:

(1) Cost/Price Benefit Factor: The proposals will be evaluated to determine the overall benefit to the government. Considerations will include industry contribution and fiscal feasibility. Fiscal feasibility includes the ability to accomplish the proposed project within government fiscal constraints, and includes the requirement for the use of other government contractors to assist in the execution of proposed effort, and the use of government furnished equipment, information, facilities, and other assets. The proposals will be evaluated to determine the extent to which the overall cost/price to the government is reasonable.

(2) Cost/Price Realism Factor: The proposals will be evaluated for cost realism to assess the likelihood that the technical and management approaches can be accomplished at the cost/price proposed.

(3) Availability and source of funds.

d. Past Performance Criteria Area: The offeror's and first tier subcontractor's past performance with government and industry in the specific interest areas or similar and/or related areas will be evaluated to assess the relative risks associated with the offeror's likelihood of success in meeting the requirements stated in this BAA. Specific areas of past experience and performance examined will include demonstrated technical and schedule performance, cost control, general responsiveness to contract requirements, customer satisfaction, and customer focus. Emphasis will be on recent, relevant experience (see past performance area under section II of this BAA).

NOTE: The areas and factors listed above are shown in descending order of importance.

5. RATING METHOD:

a. Under the technical portion in the MANPRINT/safety evaluation only, the following method shall be used: the offer will be given a pass/marginal/fail in the evaluation areas cited, however, should a fail or marginal be given, the government may be able to work with the offeror in order to assure MANPRINT/safety requirements are correctly addressed

b. Adjectival Ratings: The adjectival ratings which will be utilized for evaluating individual technical and management areas are:

(1) Excellent: Evaluation of the area indicates the offeror's proposal meets or exceeds all stated criteria by demonstrating a firm grasp of the requirements and translating the requirements into a well defined and preferred approach. Innovative approaches which push the state of the art are present. The proposal exhibits strong points, and does not contain any weaknesses or deficiencies.

(2) Very Good: Evaluation of the area indicates the offeror's proposal meets or exceeds all stated criteria by demonstrating an understanding of the requirements and translating the requirements into a well defined and feasible approach. Innovative approaches which are, at a minimum, state of the art, are present. The proposal exhibits some strong points and might contain one or more weaknesses but does not contain any deficiencies.

(3) Acceptable: Evaluation of the area indicates the offeror's proposal meets all stated criteria by demonstrating an understanding of the requirements and translating the requirements into a feasible approach. Limited innovation beyond the norm is present. The proposal may exhibit some strong points and might contain some weaknesses or minor deficiencies but does not contain any major deficiencies.

(4) Marginal: Evaluation of the area indicates the offeror's proposal meets the majority of the stated criteria but either demonstrates a limited understanding of the requirements or translates the requirements in an approach which may not be feasible. The proposal may exhibit some strong points and might contain some weaknesses or minor deficiencies but does not contain any major deficiencies.

(5) Unacceptable: Evaluation of the area indicates the offeror's proposal does not meet the stated criteria or contains one or more major deficiencies which indicate a lack of understanding of the requirements. The stated criteria can only be met with major changes to the proposal.

c. Risk Assessment:

(1) The proposal risk assessment ratings for technical and management areas are defined as follows:

(a) High: Likely to cause serious disruption of contract effort or increase in cost/price of performance even with special contractor emphasis and government monitoring.

(b) Moderate: Has some potential to cause minor disruption of contract effort or increase in cost/price of performance. Normal government monitoring will probably be able to overcome most difficulties.

(c) Low: Has very little potential to cause disruption of contract effort or increase in cost/price of performance. Normal government monitoring will probably be able to overcome most difficulties.

(2) The performance risk assessment ratings for past performance are defined as follows:

(a) High: Based on the offeror's performance record, substantial doubt exists that the offeror will successfully perform the required effort.

(b) Moderate: Based on the offeror's performance record, some doubt exists that the offeror will successfully perform the required effort.

(c) Low: Based on the offeror's performance record, little doubt exists that the offeror will successfully perform the required effort.

(d) Unknown: No performance record identifiable.

d. Definitions:

(1) **Strength** - A specific item, or technical/management approach that is within the scope of the solicitation objectives yet stands out as a significant enhancement for accomplishment of the program objectives and increases the likelihood of successful contract performance.

(2) **Weakness** - A flaw in the proposal that increases the risk of unsuccessful contract performance.

(3) **Major Deficiency** - A major item and/or gross omission which will preclude meeting a program objective and/or which results in substantial impact on areas of schedule, cost or performance. A major deficiency item is one that is clearly understood by the evaluators and cannot be corrected prior to or during negotiations without a major revision or fundamental change in the technical approach proposed by the offeror. A major deficiency prevents a proposal from having a reasonable chance of being selected for award. *NOTE: Clarification and/or additional substantiating data will not be requested concerning those areas of an offeror's proposal when a major deficiency exists.*

(4) **Minor Deficiency** – Any part of the proposal which fails to satisfy the government's objectives but can be corrected through negotiations without a major or complete resubmission of the proposal. A minor deficiency includes instances where changes in cost, effort, schedule or technical approach are not substantial. A minor deficiency includes instances where information that is essential for determining the acceptability of a proposal is lacking or when a proposal can be modified to be capable of satisfying the government objectives. *NOTE: Clarification and/or additional substantiating data may be requested concerning those areas of an offeror's proposal when a minor deficiency exists.*

SECTION V

SAFETY AND MANPRINT REQUIREMENTS

In addition to the technical portion of your proposal, there are specific requirements for Safety and MANPRINT (MANpower and PeRsonnel INTEgration) that are governed by regulation which must be included, *if applicable*, in any acceptable proposal. Contractors who develop an item, equipment or system for use by U.S. Army personnel shall include the following safety and MANPRINT requirements:

1. **SYSTEM SAFETY/HEALTH HAZARD ASSESSMENT:** Contractors shall establish a safety management program to ensure that mishap risk is identified and eliminated to preclude injury or death to the user or maintainer of the item developed.

2. MANPRINT is a comprehensive management and technical process designed to improve total system (user, hardware and software) performance through continuous integration of manpower, personnel, training, human factors, system safety, and health hazards considerations throughout the materiel (item, equipment, or system) design, development, and acquisition process. MANPRINT concerns which must be addressed during the performance of tasks are focused primarily on optimizing user/maintainer performance while minimizing error and simplifying maintenance tasks, without introducing any new safety risks or health hazards. To ensure that this objective is met, if applicable, all developmental efforts shall include MANPRINT/Human Factors Engineering analyses which identify and evaluate operability and maintainability deficiencies.

a. Early discussions with appropriate POCs will identify whether or not MANPRINT requirements apply to a particular effort. Typically, MANPRINT applies to the design, development, and acquisition of all items, equipment, or systems intended for personnel use. For efforts focused on research, MANPRINT considerations, particularly those associated with safety and health hazards, shall apply when the product of a research effort will be utilized in the development of items, equipment, or systems. Specifically, contractors shall consider the potential safety and health hazards implications that the products of their research efforts will have when/if those products are integrated into items. When MANPRINT is required, it shall be addressed in the contractor's proposal under the technical section and will be evaluated under the technical section as outlined in Section IV of this BAA.

b. For efforts requiring MANPRINT considerations, the contractor shall utilize government generated data as well as contractor generated data. The contractor shall utilize sound human engineering design principles. (Early discussions with the appropriate POC will determine relevant areas for human engineering input.) The contractor shall utilize the data for specified design-critical human body dimensions as contained in the 1988 Anthropometric Survey of U.S. Army Personnel: Methods and Summary Statistics. Contractor MANPRINT correspondence required should include (but is not limited to) the following:

(1) Explanation which documents and describes human performance errors and/or difficulties which may be encountered during operation, maintenance, and repair of the item, equipment, or system. For each error include the estimated frequency of occurrence, the cause of the error/difficulty in terms of the conditions which may have contributed to it, the consequence of the error/difficulty on system operation, and a brief explanation of the reason for the error/difficulty by the user.

(2) Explanation which describes how human performance may impact system goals by including a narrative explanation of how human error associated with operations, and the length of time required to perform operations, may affect system reliability and effectiveness.

(3) A description of potential incompatibilities among human performance capabilities and equipment to document both the aspects of performance which may be adversely affected, and the associated equipment configurations/characteristics. The contractor shall identify the controls or displays that may be needed, but are not present on the equipment. Recommended solutions to these incompatibilities shall also be included and stated in terms of redesign, alteration of tasks and/or training.

(4) Any instructions necessary for proper operation/maintenance of the equipment.

c. All contractor questions/concerns about safety and MANPRINT requirements may be discussed with the following appropriate POCs:

- o Safety: Mr. Paul Angelis, 508-233-5208, paul.angelis@natick.army.mil
- o MANPRINT: Ms. Rose Guerra, 508-233-4070, rose.guerra@natick.army.mil

SECTION VI

SCIENTIFIC AND TECHNICAL AREAS OF INTEREST

There are nine (9) major areas of interest, each categorized into more specific areas of interest.

A. COMBAT RATION RESEARCH AND DEVELOPMENT.

Shelf-stable prepared foods are essential for enabling the individual soldier to perform assigned missions and to survive battlefield threats. The requirements for compactness, storage stability; protection; modularity; enhanced nutrition, acceptance, and convenience; and producibility have become even more stringent in anticipation of supporting highly mobile, widely dispersed troops in climatic extremes.

Combat ration functionality goals can be divided into the following specific interest areas:

1. Storage stability with maximum quality and nutrient retention
2. Production and distribution efficiency
3. Consumption/Acceptance enhancement
4. Human performance maintenance/enhancement
5. Protective packaging systems

Scientific and Technical Areas of Interest:

A comparison of current capabilities versus future battlefield requirements indicates the need to explore certain new areas of scientific knowledge and technological capabilities. These Scientific and Technical (S&T) Areas of Interest are in direct support of several operational/capability requirements defining the needs of the Armed Services on the future battlefield (Objective Force). The S&T Areas of Interest also support the Army Science and Technology Objective: Combat Rations for Enhanced Warfighter Logistics which has the following main thrusts: focused/ responsive sustainment logistics, and enhanced soldier performance. In addition, each S&T area is linked to the U.S. Army Quartermaster Center and School's Vision of the Future and Full Spectrum Brigade to provide the total spectrum of support to sustain the soldier and his combat system on the battlefield of the future with focused logistics, improved responsiveness, deployability, agility, versatility, survivability, and sustainability. The spectrum of likely operations describes a need for land forces in joint, combined, and multinational formations for a variety of missions extending from humanitarian assistance and disaster relief to peacekeeping and peacemaking to major theater wars.

Protective packaging systems are crucial to the preservation of Army material in any climatic and/or hazardous environment. Material requiring protective packaging systems relate to food and food service equipment. In order for the individual soldier to perform the assigned mission and/or survive battlefield threats, the mission essential item must arrive at the right time, at the right place and provide the expected functionality and utility. Technological advances in high barrier polymer films and coatings, and active packaging are needed to meet the increasingly stringent and sometimes conflicting requirements of compactness, storage, protection, modularity, durability, convenience, degradability, and producibility. Packaging functionality includes (as applicable) protection from the following concerns: temperature extremes, insect/rodents, moisture permeation, oxygen permeation, light penetration, microbial penetration, and transportation hazards (including Air Drop). Advanced systems for tracking and monitoring quality of ration unit loads are required for flexible logistic systems for the future battlefield.

The key areas of science and technology include:

- a. Scientific information and advanced processing technologies are needed to ensure that nutrients required for optimum performance under stress are provided and are physiologically available for utilization.
- b. Improved technology is needed to produce lightweight, low-volume, nutrient-rich ration components that would be cost effective and producible by industry.
- c. Innovative processing technologies and systems are needed to provide for cost effective, high volume production of shelf stable fresh-like wet or intermediate moisture foods with maximum retention of quality factors and nutrition.
- d. Scientific information about the influence of food constituents and processing on the physical structure, chemical reactivity and microbiological safety of ration components is needed to ensure their stability under extreme storage conditions; of special interest are dairy products and other high-protein foods.
- e. Scientific information/innovative technologies on extending shelf-life/storage stability of fresh fruits and vegetables.
- f. Programming and data base development for exploiting on soldier computers a ration item optimization model to guide the selection of ration items for different missions based on energy requirements, nutritional content, personal preferences, weight, volume, and cost of items or components.
- g. Scientific information on the basis for and extent to which, specific food constituents incorporated into the food: 1) delay fatigue, 2) extend physical strength and endurance or 3) heighten alertness or enhance cognitive abilities of soldiers engaged in physically or mentally demanding tasks.

h. Scientific concepts and data are required for rapid/non-invasive detection systems (sensors) that would ensure quick response times for determination of ration quality and microbial safety.

i. Packaging technology based on non-foil high barrier polymeric material is needed to ensure protection against oxygen, moisture vapor, microbial, and insect penetrants to maintain integrity throughout the military logistics system, and to provide rations with a greater than three year shelf life.

j. Technology is needed to develop smart packaging materials/films/coatings or adjuvants possessing inherent properties for absorbing or eliminating moisture, oxygen, off odors (e.g. aldehydes), carbon dioxide, and/or ethylene. Also, develop materials containing anti-microbial agents, physiological inhibitors for fresh produce and other methodologies to control or modify the atmosphere within the package for extension of shelf life.

k. Technology is needed to develop advanced materials/films/coatings for flexible and semi-rigid polymeric containers that provide physical and chemical protection comparable to traditional high barrier materials.

l. Technology is needed to improve packaging to make it more recoverable, recyclable, degradable and capable of being decontaminated.

m. Technology, including enhanced bar code labels and integrated quality sensors, is needed to enhance secondary ration packaging systems to improve strategic handling, assembly, mobility, deployability, transportability, logistics tracking and retrieval.

n. Technology is needed to develop easy-to-open, reclosable, functional packages for dispensing both conventional and unconventional solid and reconstituted liquid ration components.

o. Technology is needed to develop flexible or semi-rigid high barrier materials that are compatible with Horizontal/Form/Fill/Seal machinery, capable of withstanding classical thermoprocessing or microwave or radio frequency sterilization as well as aseptic packaging after ohmic sterilization and capable of providing products with a three year shelf life.

p. Technology is needed to develop smart, photo or thermo-chromatic packaging materials that change color to adapt to environmental surroundings.

q. Materials technology is needed to assure that military packaging is compatible with novel and innovative processing advances.

Communication with the technical POC prior to submission of a formal proposal is essential.

Technical POC:

Dr. C. Patrick Dunne, Tel: (508) 233-5514, patrick.dunne@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier and Biological Chemical Command (SBCCOM)

Soldier Systems Center

ATTN: Alan LaBrode

AMSSB-RCF-I (N)

Kansas Street Natick MA 01760-5018

(508) 233-4670, alan.labrode@natick.army.mil

B. MILITARY OPERATIONS IN URBAN TERRAIN.

1. ***Military Operations in Urban and Restricted Domains:*** Urban environments are increasingly recognized as the most likely, complex, and resource intensive battlefield of the 21st century. U.S. forces do not possess the overwhelming technology advantages in urban environments as they do in virtually all other environments. The nature and complexity of the urban environment restricts our ability to maximize our technology advantage while providing adversaries with advantages such as inherent fortifications and the presence of non-combatants. Many of the systems which perform so well in open terrain are degraded in the dense urban environment, or cause collateral damage beyond what is politically acceptable. Many aspects of mission success depend on the effectiveness of individuals and small units. To help mitigate these issues, the U.S. Army Soldier and Biological Chemical Command at Natick (SBCCOM(N)) undertook efforts to evaluate COTS/GOTS and other emerging technologies to provide tactical advantages to U.S. forces fighting in urban environments. These issues were addressed in the Military Operations in Urban Terrain Advanced Concept Technology Demonstration (MOUT ACTD) program and were directed at the individual soldier, and on technologies that can be applied at the Battalion level or below. Several MOUT ACTD requirements were unfulfilled due to limitations and/or lack of available technology solutions. Further, additional needs were identified during program execution. Follow-on efforts will seek to address these deficiencies and will focus on the following areas:

- a. Detect and surveil personnel and vehicles to augment battlefield intelligence.
- b. Update and disseminate maps in real-time within the battalion.
- c. Identify friendly, enemy and non-combatant personnel, and associated equipments.
- d. Provide battlefield communications of any type that is not inhibited by the urban environment.
- e. Position and locate personnel in the three-dimensional urban battlespace.
- f. Mark objects or personnel of interest.
- g. Designate targets and allow hand-off of targeting information for precision engagement of personnel, equipment, structures and other threats.
- h. Protect, treat and evacuate casualties in urban environments.
- i. Provide passive night vision.
- j. Allow expeditious forcible entry of structures from all points in the three-dimensional urban battlespace.

k. Maintain force mobility through rapid neutralization of obstacles (e.g. structures, bunkers, roadblocks, wire, etc).

l. Detect objects of interest through walls of all material compositions.

Protect personnel from urban battlefield threats (e.g. ballistic, directed energy, overpressure, flame/smoke, cut/puncture, etc).

m. Detect explosives and explosive devices, remotely or otherwise.

n. Neutralize explosives and explosive devices, remotely or otherwise.

o. Conceal troop movement during urban battlefield operations.

p. Enhance vehicle survivability.

q. Conduct tactical resupply to remotely located forces in all threat environments.

r. Provide longer life, flexible power supplies.

s. Conduct non-violent crowd control operations.

t. Rapidly render vehicles immobile through active and/or passive means.

u. Identify, locate, manipulate, and neutralize electronic targets of interest.

v. Allow forces to better prepare and train for conflict in urban terrain.

2. *Unmanned Aerial and Ground Vehicles (UAV/UGVs) for Urban Operations:* The MOUT-ACTD seeks to develop UAV/UGV technologies for employment by a small team in urban environments. This includes unmanned platforms, enhancements to existing unmanned platforms, as well as integratable functionality for existing platforms. Examples of the latter could include communications relays; intelligence collection and dissemination packages; sensor packages (visual, I², thermal, acoustic, etc.); payload delivery systems (food, water, ammunition, medical supplies, crowd control agents, obscurants, etc.); or explosive delivery/emplacement. Technology candidates should exhibit the following characteristics:

a. Technical readiness level of 4-6.

b. Minimized size and weight.

c. Minimized power requirement.

d. One-person operable.

e. Portable by no more than two (2) persons.

f. Stand-alone system: requires no large residuals such as HMMWVs or other vehicle/infrastructure for support.

SPECIAL NOTE: The development timeframe for the effort described in #2 above is 1 Oct 01 through 30 Sep 02. Therefore, all concept papers, proposals, and administrative inquiries on this subject shall be submitted no later than 30 Sep 01.

Communications with the technical POC prior to submission of a formal proposal is essential.

Technical POC: Mr. Andrew J. Mawn III, (508) 233-4262, andrew.mawn@natick.army.mil

All concept papers, proposals, and administrative inquiries shall be submitted to:

US Army Natick Soldier Center
ATTN: AMSSB-RSC-MA(N) (Andrew Mawn)
Kansas Street
Natick, MA 01760
(508) 233-4262, andrew.mawn@natick.army.mil

C. FOOD SERVICE/FIELD SERVICE.

1. *Combat Food Service Equipment for Individual and Group Feeding.* Ideas, concepts, and technologies applicable to sustaining troops on the battlefield are needed for four general mission areas: consolidated large groups (550 troops), companies (150 troops), squads (12 troops), and individual troops. Responsive proposals are directed towards minimizing the expenditure of energy, manpower, and other resources and materiel, and yet provide maximum flexibility and effectiveness in responding to the total food service requirements of troops operating under all battlefield threats, in all climatic and terrain conditions, and at all levels of commitment. Generally, the requirements are for systems that can be rapidly deployed/employed; are easily transported; offer quick response times; are highly efficient (i.e., require least manpower, fuel, water, etc.); support all types of rations and menus; and, can be readily adapted to any battlefield scenario. As such, equipment must be compact, lightweight, versatile (e.g., modular, multi-functional, multifuel capability, etc.), energy efficient, reliable, and easily operated and maintained. In addition, effective field sanitation and waste handling/disposal concepts are needed.

Field feeding equipment and systems can be classified according to the following specific interest areas:

(a) Individual

- (1) Ration and beverage heating
- (2) Beverage chilling

(b) Group

- (1) Heat and Serve
- (2) Storage of perishable fresh and frozen foods
- (3) Preparation of meals
- (4) Transportation, distribution, and service
- (5) Waste management, reduction, and recycling

(6) Sanitation

Scientific and Technical Areas of Interest:

A comparison of current and emerging capabilities versus known and projected requirements of the Military Service indicates an interest in the following technical areas:

- a. Diesel/JP8 combustion technologies including vaporization, atomization, and gasification (catalytic or otherwise) that are efficient, clean, reliable, and maintainable.
- b. Exothermic and endothermic chemical technologies for heating rations and chilling beverages that are safe, efficient, and compact and/or reusable.
- c. Heat transfer technologies that will safely utilize all forms of generated/cogenerated energy (e.g., chemical, electrical, fuel combustion, etc.) for cooking, heating and cooling rations and water.
- d. Refrigeration technologies, or other methods for safely storing perishable foods, that operate with minimum expenditure of energy and limited weight/space demands for all modes of transport, storage, and distribution of perishable subsistence in the field.
- e. Equipment technologies for safely thawing cases and pallets of frozen foods.
- f. Methods and equipment to determine real-time biohazards in foods.
- g. Material technologies for new structural and insulative materials appropriate for food service equipment that provide improved durability, strength, energy efficiency, and cost.
- h. Equipment and systems technologies to reduce or recycle food service waste and/or to assist in efficient, safe waste handling and disposal in the field in an environmentally acceptable manner.
- i. Equipment technologies to ensure the sanitary protection of food and beverages during assembly, preparation, service, and distribution in the field, and systems concepts for efficient and effective cleaning and sanitation of field feeding equipment.
- j. Novel power supplies for efficiently and effectively producing/storing, and/or providing electric power to operate field feeding equipment, including consideration of such factors as size, weight, cost, reliability, safety, maintainability, useful life, and environmental factors.
- k. Equipment technologies, novel methods, and devices for heating food and chilling water on aircraft and in vehicles.

l. Equipment technologies that offer improvements in baking, roasting, steaming, boiling, simmering, and grilling.

m. Equipment and technologies to reduce cooking, cleaning, and maintenance labor in Navy ship galleys.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Don Pickard, Tel: (508) 233-5036 don.pickard@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier and Biological Chemical Command (SBCCOM)

Soldier Systems Center

ATTN: Alan LaBrode

AMSSB-RCF-I (N)

Kansas Street Natick MA 01760-5018

(508) 233-4670, alan.labrode@natick.army.mil

2. *Unit/Organization Equipment.* Unit/organizational and field service support equipment are required to sustain and increase the efficiency, survivability, and operational capability of the soldier in the battlefield while meeting individual needs. Equipment required to perform a variety of field functions must be efficient, reliable, compact, lightweight, easily operated /maintained, and logistically supportable. This equipment must also be rugged enough to withstand field transport, set-up under high stress conditions, repeated set-up and tear down, and drastically varying field conditions and climates. Future battlefield requirements dictate the need for more mobile, NBC survivable and multi-functional equipment in addition to the need to reduce the logistical burden of supplying water, fuel, and electrical power to the field.

Specific Interest Areas include:

- a. Mobile Laundry Systems
- b. Space Heaters for Tentage and Shelters
- c. Water Heaters for Laundry, Showers, and General Purpose Hot Water (Including non-powered immersion type heaters)
- d. Field Clothing and Textile Repair Equipment
- e. Field Sanitation and Hygiene Equipment

- f. Non-Powered Field Lighting
- g. Mortuary Affairs Equipment
- h. Latrines and Incinerators for Human Waste Collection and Disposal in the Field
- i. Lightweight portable shower systems
- j. Field furniture
- k. Portable Field Waste Water Treatment/Recycling Systems
- l. Co/tri-generation technologies

Scientific and Technical Areas of Interest:

A comparison of current capabilities versus future combat service support requirements dictates interest in the following major areas of scientific knowledge and technological capabilities:

- a. Advanced technology to allow the exploratory development of diesel/jet fuel-fired clothes dryers, microwave clothes dryers, and water heaters suitable for field use.
- b. Advanced combustion technology to allow the exploratory development of clean-burning, efficient, and safe multi-fuel fired non-powered heaters for the field. This includes both space heaters and immersion heaters for water. (“Non-powered” means that no external electrical power is required for operation.)
- c. Advanced technology to allow the exploratory development of photocopy equipment suitable for field use, with high reliability and low maintenance support requirements.
- d. Environmentally safe dry-cleaning solvents which are compatible with Army clothing and finishes.
- e. Advanced water treatment technologies to allow the safe re-use or disposal of waste water from field showers, laundries, and latrines.
- f. Technology to produce low-cost, high efficiency, lightweight equipment for heating, ventilating, uniform heated/cooled air distribution, and conditioning for tentage applications (including collective protection).
- g. Novel and exploratory concepts to effectively and reliably identify, process, and safely transport (including air transport) NBC contaminated human remains from the NBC battlefield.

h. Novel and exploratory concepts to provide non-powered field lighting using liquid fuels such as diesel and jet fuel.

i. Advanced small capacity multi-fuel combustion, heat transfer, and material technologies to allow development of lightweight highly portable general purpose hot water heaters for field use.

j. Advance technologies to permit the development of advancement of equipment identified in the functional areas above to better the quality of life for the soldier in the field.

k. Advanced laundry technologies for reducing the use of detergents and water over existing systems.

l. Advanced technology for the development of lightweight, modular, deployable field latrines and advanced methods of treatment and disposal for waste human from latrines in the field.

m. Advanced technology for developing a lightweight, portable incinerator that will provide a safe, economical, and environmentally sound means of disposing of waste products (including human wastes) generated during military operations.

n. Advanced technology to allow development of compact, portable, lightweight shower units for use by soldiers on initial entry into theaters of operation.

o. Novel means of power generation (thermoelectric, thermophotovoltaics, solar, etc) to allow field service equipment such as heaters, showers and laundries, to be self-powered for operation in remote/isolated locations w/o need of tactical generators.

p. Novel concepts in field furniture that will reduce the logistics burden, be easily deployable and lightweight, rugged, and enhance utility/effectiveness in the field.

q. Novel waterless or low water cleansing technologies for field showers and personal hygiene.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Joseph Mackoul, Tel: (508) 233-5592, joseph.mackoul@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
ATTN: AMSSB-PM-RSS-F(N) (Mr. Joseph Mackoul)
Natick, MA 01760-5057
(508) 233-5592

D. WARRIOR SYSTEMS TECHNOLOGIES.

1. ***Ballistic Protection for Individuals.*** Ballistic protection for the individual soldier involves protection of the body (to include the head) against a variety of projectiles which differ widely in shape, size and impacting velocity. New materials are required to meet these broad ballistic threats and to lighten the load carried by the soldier.

Scientific and Technological Areas of Interest:

A comparison of current capabilities versus future battlefield requirements dictates interest in the following major areas of scientific knowledge and technological capabilities.

Technology is needed for:

- a. New polymers for clothing which can provide increased tensile properties, increased ballistic protection and lighter weight.
- b. Highly ordered polymers e.g. liquid crystals, for High Performance (HP) fibers.
- c. Improvements to existing HP fibers (e.g., surface modification, processing and composition variations)

A need also exists for:

d. Novel concepts to identify the best technical approach to provide ballistic protection to the individual soldier against multiple ballistic threats. Such concepts should identify ballistic defeat mechanisms for fragmentation and handgun threats. Upon identification of and understanding defeat mechanisms, further efforts should establish the feasibility of systematically combining those mechanisms into lightweight, flexible, minimum-bulk structures of approximately 1 lb per square foot (or less) providing a high level of protection against the identified threats.

e. Unique and novel textile and composite structures which optimize the ballistic protection of currently available materials for soft body armor and helmet applications.

f. Studies of blast overpressure and behind armor effects on the individual.

g. Novel concepts to identify the best technical approach to provide ballistic protection to the individual soldier against multiple ballistic threats. Such concepts should identify ballistic defeat mechanisms for current ballistic threats including small arms threats and flechettes. The small arms threats range from 5.45mm to 7.62mm ball and armor piercing (AP) with limited interest in 12.7 mm AP. Upon identification of defeat mechanisms, further efforts should establish the feasibility of

systematically combining those mechanisms into lightweight, minimum-bulk structures using unique and novel textile and/or composite systems (with preference for flexible systems up to and including the .30 caliber ball).

h. Additional concepts may include transparent armor, smart materials for armor and other functionalities, and nanotechnology approaches to new materials.

Some of the technical approaches for topics within this solicitation may be subject to export control restrictions under existing export control laws, and or required to be conducted as classified projects as outlined in the National Industrial Security Program Operating Manual (NISPOM) and its supplements. Contractors who would like to submit proposals pertaining to such technologies are encouraged to contact their local Defense Investigative Service (DIS) Industrial Security representative or the Technical POC listed in the solicitation for guidance.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Ms. Janet Ward, Tel (508) 233-5462, janet.ward@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Center
ATTN: AMSSB-RIP(N)/Ms. Heather Parker
Natick, MA 01760
(508) 233-4929, heather.parker@natick.army.mil

2. Individual Laser Eye Protection. From the point of view of the individual combat soldier, the low-energy lasers currently found on the battlefield such as range finders and target designators represent the most imminent danger from directed energy. In the very near future, the ready availability of tunable, or agile, lasers will offer the potential for an even more serious threat to the eyes of individuals.

Protection against the fixed-frequency lasers has been shown to be attainable by the use of dye absorbers and Bragg reflectors, such as holograms. These systems have been used in combination with a polycarbonate substrate to produce devices that provide soldiers with the required level of ballistic protection and fixed frequency transmittance. Poor durability and high cost are still to be overcome.

No technology investigated thus far has shown significant protection for the foot soldier against the future battlefield hazards that will be created by tunable lasers. Stringent weight and bulk limitations, added to the intrinsic requirements of response time, broadband response and high visual transmittance, make this problem a formidable one.

Scientific and Technical Areas of Interest:

A comparison between current capabilities versus future battlefield requirements indicates interest in the following major areas of scientific knowledge and technological capabilities.

Technology is needed for:

- a. Photopolymer-based or other improved Bragg reflecting filters with high visual transmittance to provide specified laser wavelength protection in the visible and near-infrared regions of the spectrum.
- b. Materials or systems, or combinations thereof, to reject laser light in the visible spectrum having a visible transmission (scotopic and photopic) of at least 45% in the quiescent state.
- c. Lightweight, compact "shutter" systems which reject all visible and near-infrared wavelengths from lasers only, with zero or near-zero response time.

Some of the technical approaches for topics within this solicitation may be subject to export control restrictions under existing export control laws, and/or required to be conducted as classified projects as outlined within the National Industrial Security Program Operating Manual (NISPOM) to include its supplements. Contractors who would like to submit proposals pertaining to such technologies are encouraged to contact their local Defense Investigative Service (DIS) Industrial Security representative or the Technical POC listed in the solicitation for guidance.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Barry DeCristofano, Tel: (508) 233-4255 barry.decristofano@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Center
ATTN: AMSSB-RSS(N) (Ms. Gail Bernheart)
Natick, MA 01760-5020
(508) 233-4706, gail.bernheart@natick.army.mil

3. *Chemical/Biological Protection for Individuals.* The protection of the soldier from exposure to hazardous chemicals, such as chemical warfare agents, is essential to mission accomplishment on today's battlefield and that of the future. This protection is currently accomplished through the use of an activated carbon system, the use of semi-permeable material systems, and the use of impermeable barrier materials. The activated carbon system is used in protective overgarments and affords protection by adsorbing hazardous chemicals. The impermeable barrier materials consist of rubber, coated, and multilayer laminate fabrics found in gloves, boots and special purpose (e.g. depot storage /demolition/explosive ordnance disposal) ensembles, which afford protection by acting as a physical barrier to chemicals.

Future needs for chemical-protective uniforms require that they protect against multiple threats, including toxic aerosols and biological agents, be decontaminable and reusable. These uniforms must also be comfortable in all climates and not impair the mobility or performance of the soldier. The materials for these uniforms should be lightweight, have improved protection, lessen the propensity for heat stress, have increased durability and shelf life, and be reusable through the use of reactive materials which will detoxify the chemical warfare (CW) agents. There is a need for the development of methods for measuring adsorption of agents and agent surrogates within protective materials (particularly liquid challenge/liquid penetration) and for determining the reaction products (quantitative and qualitative) that originate from detoxification chemistry taking place in catalytic and reactive materials.

Scientific and Technical Areas of Interest:

A comparison of current capabilities versus future battlefield requirements dictates interest in the following major areas of scientific knowledge and technological capabilities:

a. Novel materials and concepts that could provide protection against highly toxic compounds, including military offensive chemical agents (blister, nerve, etc.) in gross contamination amounts for extended periods (greater than four hours), and biological agents. We are also interested in related exploratory development proposals such that feasibility can be established for the development of improved chemical-protective and biological agent-protective suits, garments, gloves and socks. Proposals which emphasize lighter weight, improved protection, improved decontamination (through the use of self-decontaminating materials or materials which can be regenerated in the field), improved durability and launderability, reduced heat stress, and other human factor concerns are of particular interest.

b. Proposals for a low cost service life indicator that can be worn or stored inside a chemical protective garment package to visibly display or provide some reading as to the degree of protection remaining in the garment, such as dendrimer reactive are of interest as are applications of novel polymers and smart materials.

c. Research proposals to reduce/minimize the need for live agent testing to verify the chemical protection of current carbon based sorptive systems.

d. A research proposal on advanced semipermeable membrane technology that allows selective permeation of moisture while preventing penetration of chemical warfare agents and toxic aerosol.

e. Garment design and closure systems for CB protective clothing system. We are interested in elastic/stretchable polymeric materials such as thermoplastic elastomers for development of closure systems that provide and maintain chemical/biological agent protection in normal and in stretched states.

f. Proposals to investigate mechanisms and garment treatments that capture and possibly react with aerosolized (<5micro) threat particles. Key to this work would be to demonstrate that such treatments can remain effective during the normal use and service life of the protective garment.

Some of the technical approaches for topics within this solicitation may be subject to export control restrictions under existing export control laws, and or required to be conducted as classified projects as outlined in the National Industrial Security Program Operating Manual (NISPOM) and its supplements. Contractors who would like to submit proposals pertaining to such technologies are encouraged to contact their local Defense Investigative Service (DIS) Industrial Security representative or the Technical POC listed in the solicitation for guidance.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POCs:

Dr. Eugene Wilusz, Tel: (508) 233-5486, eugene.wilusz@natick.army.mil

Mr. Quoc Truong, Tel: (508) 233-5484, quoc.truong@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Center

ATTN: AMSSB-RIP(N)/Ms. Heather Parker

Natick, MA 01760

(508) 233-4929, heather.parker@natick.army.mil

4. *Flame and Thermal Protection for the Individual Soldier.* Flame and thermal protection for the individual soldier involves protection of the body against a variety of fire hazards that occur in combat (rural and urban warfare), operations other than war, and standard operational duty. New, low cost materials are required to protect against these hazards and reduce burn injuries.

Science and Technology Areas of Interest:

A comparison of current capabilities versus battlefield requirements dictates interest in the following major areas of scientific knowledge and technological capabilities.

Technology is needed for:

a. New, low cost fibers for clothing applications (woven, knit, and batting fabric structures) which provide flame resistance without melt drip characteristics.

POCs:

Ms. Carole Winterhalter, Tel: (508) 233-5460, carole.winterhalter@natick.army.mil

Ms. Peggy Auerbach, Tel: (508) 233-4074, margaret.auerbach@natick.army.mil

b. Improvements to existing fibers (e.g. incorporate novel flame-retardant chemicals, flame suppressors or char formers into conventional low cost fibers). Novel flame-retardant topical treatments and processes for cotton and other fibers.

POCs:

Ms. Luisa Santos, Tel: (508) 233-5475, luisa.santos@natick.army.mil

c. Novel elastomers or coatings providing flame resistance and liquid resistance for chemical protective clothing applications (including gloves and boots).

POC:

Dr. Eugene Wilusz, Tel: (508) 233-5486, eugene.wilusz@natick.army.mil

A need also exists for:

d. Novel concepts and approaches to integrate multifunctional protection capabilities into single layer outershell fabrics weighing eight ounces per square yard or less. Such concepts should integrate flame and thermal protection with other protective capabilities such as environmental, signature management and electrostatic dissipation.

POC:

Ms. Carole Winterhalter, Tel: (508) 233-5460, carole.winterhalter@natick.army.mil

e. Studies investigating the flame and thermal protection effectiveness of materials and clothing systems, to include analysis of the material pyrolysis, ignition and combustion characteristics; novel lab-scale apparatus and methodology; correlation of lab-scale with full-scale manikin testing.

POC:

Dr. Calvin Lee, (508) 233-4267, calvin.lee@natick.army.mil

Mr. Il Young Kim, (508) 233-4296, il.kim@natick.army.mil

f. Computer modeling and simulation capability to evaluate developmental flame and thermal protective clothing materials and systems, and/or prediction tools to identify casualty reduction in terms of reduced burn injury.

POCs:

Mr. Barry DeCristofano, Tel: (508) 233-4255, barry.decristofano@natick.army.mil

Mr. Dave Tucker, Tel: (508) 233-4174, dave.tucker@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Center
ATTN: AMSSB-RIP(N)/Ms. Heather Parker
Natick, MA 01760
(508) 233-4929, heather.parker@natick.army.mil

5. **Countersurveillance.** Survivability is fundamental to the conduct of warfare. The countersurveillance mission is to enhance the survivability of the warfighter on the battlefield by providing textiles for uniforms, skin treatments, individual equipment and tentage that reduce detectability by various sensors. These sensor threats include the eye, near-infrared image intensifiers, thermal imagers, radar and multi-spectral sensors. Signature suppression with textile and skin camouflage materials usually take the form of dyes/pigments, additives and coatings, although novel and innovative solutions are encouraged. Thermal countermeasures must not degrade existing countermeasures for visual and near-infrared protection. They should be passive, and hypo-allergenic and not increase the bulk or heat stress over levels currently imposed by existing clothing systems.

Scientific and Technical Areas of Interest:

Analysis of user requirements and current capabilities indicate the need for:

a. Near term and far term research proposals related to novel concepts and materials that:

- (1) Defeat the threat of thermal sensor detection.
- (2) Defeat the threat of radar detection.
- (3) Provide novel camouflage solutions to current and future sensor threats by exploring the applicability of a wide variety of technical approaches.
- (4) Defeat multispectral threat sensors.
- (5) Provide protection to exposed hands and facial areas to defeat multispectral sensor detection.

b. Exploratory development proposals related to the above areas under which the feasibility of such proposals may be demonstrated.

Some of the technical approaches for topics within this solicitation may be subject to export control restrictions under existing export control laws, and or required to be conducted as classified projects as outlined in the National Industrial Security Program Operating Manual (NISPOM) and its supplements. Contractors who would like to submit proposals pertaining to such technologies are encouraged to

contact their local Defense Investigative Service (DIS) Industrial Security representative or the Technical POC listed in the solicitation for guidance.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POCs:

Ms. Lisa Hepfinger, Tel: (508) 233-5146, lisa.hepfinger@natick.army.mil
Mr. Richard Cowan, Tel: (508) 233-5474, richard.cowan@natick.army.mil
Mr. James Fairneny, Tel: (508) 233-5209, james.fairneny@natick.army.mil
Ms. Anabela Dugas, Tel: (508) 233-5470, anabela.dugas@natick.army.mil
Mr. Maurice Larrivee, Tel: (508) 233-4447, maurice.larrivee@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Center
ATTN: AMSSB-RIP(N)/Ms. Heather Parker
Natick, MA 01760
(508) 233-4929, heather.parker@natick.army.mil

6. Body Worn Smart Materials. Electronic subsystems, devices, and sensors are being miniaturized for personal use, however; no technology exists to integrate these electronics into textiles, protective clothing, or combat field equipment. There is an interest in the development of conductive materials and integration of these materials and electronics into textiles, clothing and individual equipment to provide multiple performance enhancements. Desired materials and products shall be safe to wear, lightweight, flexible, launderable, resistant to corrosion and water contamination, and durable to wear and tear.

Scientific and Technological Areas of Interest:

A comparison of current capabilities versus future battlefield requirements dictates interest in the following major areas of scientific knowledge and technological capabilities.

Technology is needed for:

New fiber forming polymers that provide conductive, radiative or optical performance.
Novel manufacturing processes to integrate electro-optic fibers, yarns, films, and materials into fabrics.
Techniques to integrate or mount battery powered wireless or wired sensors into or onto fabrics.
Ergonomic connection technologies to attach/detach electronics and sensors to/from fabrics.
Methods to translate standard cabling such as USB, Firewire IEEE 1394, and coax into flat, lightweight, flexible, wearable textile based conductors.
Development of textile based body worn VHF/UHF antennas and integration of the antennas into protective clothing and equipment.

Communication with the technical POC prior to submission of a formal proposal is essential.

Technical POCs:

Ms. Carole Winterhalter, Tel: (508) 233-5460, carole.winterhalter@natick.army.mil

Mr. James Fairneny, Tel: (508) 233-5209, james.fairneny@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Center

ATTN: AMSSB-RIP(N)/Ms. Heather Parker

Natick, MA 01760

(508) 233-4929 heather.parker@natick.army.mil

7. *Head Mounted, Hand Held, Body-Worn Systems and Smart-Lightweight Electronic Components/Modules for Information Management.* The advanced tactical helmet and body worn electronic systems, components and smart sensors for future individual soldier systems will integrate communications, NBC protection, tactile information display, weapon sighting/fire control functions, and directed energy weapons (DEW) protection on the warfighter. This will greatly enhance the individual soldier's survivability on the battlefield. Advanced technology is needed for the miniaturization of lightweight, durable, reliable, low-power requirement sensors, optics, displays and Helmet and Head Mounted Displays (HMD), remote threat detectors, and wearable smart electronic components/modules that might be integrated into textiles.

Scientific and Technical Areas of Interest:

A comparison of current technology and research activity, and the future needs of the user, has revealed the following areas of interest:

a. Research proposals related to advancing the current technology for lightweight integrated helmet, head mounted display (HMD), large area displays and body-worn systems that may lead to enhancing the individual soldier's survivability on the battlefield; special interest areas include human systems integration, miniaturization, increased durability and reliability, and components having low power as well as new power solutions that meet manportable system requirements. Specific examples of body worn system capabilities include: computers, integrated electronic modules, inter- connections in fabrics, wearable battery technologies, combat identification, tactical engagement simulation capability, system voice control, physiological/medical sensors and data management, integration of individual/team weapon system sensors and controls.

b. Research proposals for various lightweight low power, high resolution helmet and head mounted displays, large area displays and indirect weapon sighting systems, communication and information management capabilities and devices to enhance and protect individual soldier's sight and hearing as well as to protect against the varied threats expected in the intense battlefield environment of the future, such as, threat detecting sensors (e.g., chemical/biological, motion, unexploded ordnance, RF, seismic, acoustic and others) and smart electronic modules that think, sense and communicate to the warfighter,

such as miniature robotics and robotically controlled sensors, to enhance visualization and situational awareness.

c. Research proposals for low weight, low power, high efficiency man portable/wearable systems and components (e.g., antennae, power and/or data bus, sensors) that can be integrated into textiles and other protective structures.

d. Research proposals for ballistic transparencies that integrate with Tech Base areas such as DEW protection and HMD and manportable IR and daylight readable display technologies using minimal energy output levels as well as a potential for deicing and defogging capable of meeting performance requirements across all environments.

e. Research proposals for HMDs and body-worn components, sensors and systems and system components using innovative display and sensor technologies capable of innovative human mounted integration. Critical areas of interest include some or all of the following display attributes:

- active matrix displays and backplanes
- flexible displays
- reduce bulk and weight
- increase field of view
- multifunctional displays, modules and sensors
- reduced power requirements
- bistability and increased bandwidth displays and sensors
- increase pixel resolution/monochrome/color
- incorporate see-through/ reflective/diffractive/scanning/moems/nanotechnology
- technology/occluded/see around/handheld/body-worn
- electronic components that may be integrated into textiles
- components that think, sense and communicate to the warfighter

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Henry Girolamo, Tel: (508) 233-5071, henry.girolamo@natick.army.mil

Contract Data Rqmts POC:

Mr. Tom Gilroy Tel: (508) 233-5855, thomas.gilroy@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Center
ATTN: AMSSB-RSS (Ms. Gail Bernheart)
Natick, MA 01760
(508) 233-4706, gail.bernheart@natick.army.mil

8. **Biomechanics.** Biomechanical tools and data are currently being developed to inform the design of boots and load carriage gear that reduce injuries, delay fatigue and enhance dismounted soldier mobility. There is a need for detailed information on the forces acting on the soldier's musculoskeletal system as well as how their gait, range of motion, rates of movement, energy expenditure, and stamina are affected by their load, its distribution on the body, the terrain and grade of the environment, and obstacles presented by the environment, such as in urban terrain.

Scientific and Technical Areas of Interest:

A review of the existing data and models has revealed the following areas of continuing scientific and technical interest:

- a. Information on the manner in which factors such as total weight and centers of mass of jumpers and their equipment, parachute design, landing velocity, body position, and environmental variables, including terrain and lighting levels, affect paratroopers' performance and the risk of injuries in a jump.
- b. As the concept of physical fightability emerge as critical system criteria for acquisition it is essential to develop a suite of biomechanical tools to assess the physical fightability of soldier systems of dismounted troops in a broad range of environments.
- c. Determine to what degree the biomechanical measures of fatigue may be used to predict performance failure of critical soldier tasks.
- d. Develop predictive fatigue algorithms and integrate them with physiological monitoring systems to provide commanders with real time information on the performance capabilities of their soldiers.
- e. Investigate the effects of acute and chronic head borne weight on soldier performance, fatigue and the incidence of injuries.
- f. Develop physics based data and analytic models/virtual prototyping tools of human locomotion and combat environment individual movement techniques (IMTs) to provide design guidance for individual soldier equipment.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Dr. Edward Hirsch, Tel: (508) 233-5809, edward.hirsch@natick.army.mil

Mr. Bob O'Brien, Tel: (508) 233-4924, robert.obrien@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSSB-RSS(N) (Ms. Gail Bernheart)
Natick, MA 01760-5020
(508) 233-4706, gail.bernheart@natick.army.mil

9. *Materials Nanotechnology.* Recent developments in materials research have shown that it is possible to achieve a non-linear enhancement of material properties in composite systems where the size of the phase domains is in the nanometer range. Examples include the numerous reports of small amounts (5-10%) of silicate nanoparticles (such as montmorillonite clays) giving rise to the same level of mechanical properties in polymers as are typically achieved with loadings of 30-50% of micron-sized fillers. In some cases, properties are observed in nanoscale materials that have not been realized in more conventional material structures. Examples include the use of nanometer-scale fibers in semi-permeable membrane filtration systems.

Scientific and Technological Areas of Interest:

There is a need for research and development of materials incorporating nanometer-size architectures, having enhanced properties relative to existing materials in the area of physical properties. Composites of polymers with nanometer-scale reinforcements (particles or fibers) may offer enhanced mechanical properties allowing equipment to be fabricated with less weight and bulk than current designs and possibly at lower cost. Particular areas of application for such materials include personnel armor, airdrop systems, shelters and load carriage systems. In addition to the fabrication of new materials, research efforts should attempt to identify mechanisms of property enhancement in nanophase materials, which could aid in the design of structures for particular applications.

Specific materials of interest include new nanostructured, nanophase materials or nanocomposite materials of polymer/polymer, polymer/ceramic, polymer/metal or other compositions that have the potential to provide specific performance gains over existing engineering materials or have the ability to incorporate multiple material functionality into a single material.

A major barrier to the fabrication of nano-structured materials is the efficient dispersion of nanometer particles in a host matrix. Research dealing with processing techniques, such as self-assembly phenomena or other means of economically creating nanoscale architecture in materials is of interest.

Communication with the Technical POCs prior to submission of a formal proposal is essential.

Technical POCs:

Dr. Michael Sennett, Tel (508) 233-5516, michael.sennett@natick.army.mil
Dr. Heidi Gibson, Tel (508) 233-5487, heidi.gibson@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSSB-RSS(N) (Ms. Gail Bernheart)
Natick, MA 01760-5020
(508) 233-4706, gail.bernheart@natick.army.mil

10. ***Wearable Solar Cells.*** The power incident from the sun, at the earth's surface, is on the order of 1kW/m^2 . Conversion of this power, even at moderate efficiencies could be a major renewable, clean and inexpensive energy source, there for the taking. The operation of solar cells is based on the photovoltaic effect, which is the generation of a voltage and/or current by absorption of light in certain materials or combinations of materials. To date, the primary materials that have found commercial application are a variety of inorganic materials including silicon (crystalline, multicrystalline and amorphous), copper indium diselenide, indium phosphide and gallium arsenide, with cell efficiencies averaging around 18-20%. These materials however remain limited because of high cost and inability to process them into lightweight, conformal devices. Therefore, much research has been devoted to the development of new materials that can address these limitations and further improve device efficiencies. It is well known that organic materials can offer lower cost, lower weight, facile processability and tailorability of the photoelectric response. However, the efficiencies of organic based devices are currently too low for practical use. Recently, it has been demonstrated that cells composed of both organic "light-harvesting" materials and inorganic "nanocrystalline" (high surface area) materials can provide sufficient conversion efficiencies and current densities to make practical applications feasible (Grätzel). This is a relatively new realization in photovoltaic research and it is anticipated that improvements in these unique "hybrid" (organic/inorganic) materials, along with ongoing developments in nanostructured materials, will provide exciting advances for wearable solar cell devices.

Scientific and Technological Areas of Interest:

There is a need for research to develop new materials and new methodologies to effectively integrate promising organic and inorganic materials into hybrid devices for wearable solar cells with maximum energy conversion efficiencies. Towards this, new light-absorbing materials that are more stable and more efficient light absorbers are needed. Also, new processing approaches are needed that can increase the surface roughness to improve energy collection and maximize interfacial interactions such that charge separation occurs before recombination. Devices that are portable, rugged, lightweight, flexible and conformal to a variety of materials, in particular fabrics, are desired. Organic light-harvesting dyes or polymers coupled with inorganic semiconductor materials into interpenetrating nanofibrous or nanocomposite structured networks may offer a low cost, viable approach to meet these needs. Particular areas of application include wearable solar batteries for the soldier (garments, helmets, backpacks and removable patches) to provide modular energy units and tentage materials for shelters. In addition to the development of these photovoltaic devices, coupling with appropriate capacitors for energy storage as well should also be considered.

Materials of interest include new nanofibrous or nanocomposite structured organic/inorganic hybrid systems. Specific materials may include light harvesting and charge-transfer dyes or polymers, conducting polymers, inorganic semiconductor materials and nanoparticles, flexible and transparent electrodes, and conducting fabrics.

A major barrier to the fabrication of wearable solar cells will be effective integration of the components in the device such that energy collection is maximized and charge recombination is minimized. This will be necessary to reach conversion efficiencies high enough for practical application.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Dr. Lynne Samuelson, Tel: (978) 934-3792, lynne.samuelson@natick.army.mil

All concept papers submitted to:

Dr. Lynne Samuelson
U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSSB-RSS-M(N)
Natick, MA 01760-5020

All proposals and administrative inquiries should be submitted to:

Ms. Gail Bernheart
U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSSB-RSS(N)
Natick, MA 01760-5020

11. Anthropometry. The NSC has traditionally maintained an extensive anthropometric database on U.S. Army and other military personnel. Anthropometric data are needed on Active Duty, National Guard, and Army Reserve personnel in order to facilitate the design and sizing of personal protective clothing and equipment systems. These data are also required for the design and layout of general purpose workstations and combat vehicle crewstations. Virtually all military system development requires access to accurate body size data at some point in the design process. U.S. Army anthropometric data are also used by military contractors, other government agencies, and industry. The most recent anthropometric survey of U.S. Army personnel was conducted in 1988, and a need currently exists to update this information.

Scientific and Technical Areas of Interest

- a. Obtain traditional anthropometric measurement information on Active Duty, National Guard, and Army Reserve personnel in accordance with data collection standards established during the 1988 survey of U.S. Army Personnel.

- b. Develop and implement quality control measures to include data editing and other means that serve to ensure the accuracy of anthropometric data collected during the course of the survey.
- c. Develop data collection methods and procedures as required to support the acquisition of a well-defined set of body measurements that permit the assessment of anthropometric changes over time and also permit the comparison of U.S. Army personnel data with other U.S. and foreign military populations.

Traditional anthropometric data collection on survey participants will be performed by the offeror whereas three-dimensional whole body and body segment images of survey participants will be collected by U.S. Army anthropologists. Close coordination between the government and offeror on such matters as the final dimension list, body landmarking requirements, quality control implementation, and data cleaning shall be required throughout the duration of this large scale data collection effort. It is anticipated that a cost sharing contract will be used to execute this anthropometric data collection effort.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Steven Paquette, Tel: (508) 233-5430, steven.paquette@natick.army.mil

All concept papers, proposals, and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSSB-RSS(N) (Ms. Gail Bernheart)
Natick, MA 01760-5020
(508) 233-4706, gail.bernheart@natick.army.mil

12. *Advanced Protection and Integration Technologies and Systems.* As protective and structural technologies get more advanced, opportunities emerge to integrate multiple functions into fewer layers and components. As the Army transforms over the next decade to a lighter, more agile and lethal force, the individual warrior's set of protective clothing and individual equipment must also transform. The Army is seeking a revolutionary approach to system design and integration using emerging technologies and technology trends. New and emerging technologies and design concepts must be explored to provide the warrior with combat overmatch through significant advances in survivability, mobility, and cognitive/physical warrior performance. An advanced integrated combat uniform system will emerge as the foundational centerpiece for the human interface, load bearing, protection, and electronics hardware linkages for the future warrior systems. System weight and bulk reduction are key goals of this effort. Significant mission benefits to the soldier include: longer mission time (endurance) in hot/cold, and/or chemical/biological environments; improved warrior performance, both physical and cognitive in all mission environments; reduced heat stress casualties; reduced water

intake requirements; enhanced cold weather protection; and enhanced mobility due to reduced bulk and protrusion of electronic devices and interfaces.

Scientific and Technical Areas of Interest:

Research proposals to develop combat uniform and integration system design concepts and breadboard prototypes, to include integration of multiple technologies into fewer textile-based structures and/or system components. Examples include, but are not limited to, integration of ballistic protection and load bearing functions, integration of chemical/biological agent protection with environmental protection and signature management, integration of novel closure and interfaces for advanced protection and electronic networking capabilities, integration of power/data bus, sensors and connectors into textiles and other protective structures.

Research proposals for novel design approaches and technologies to provide enhanced passive physiological management, active ventilation, and/or heating and cooling concepts suited for dismounted soldier applications.

Research proposals to develop and implement measures, assessment tools, and analysis of cognitive and physical warrior performance, especially as it relates to the soldier's body worn system.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC: Ms. Cheryl Stewardson, Tel: (508) 233-5427, cheryl.stewardson@natick.army.mil

All concept papers should be submitted to:

Ms. Cheryl Stewardson, Tel: (508) 233-5427
Email: cheryl.stewardson@natick.army.mil
U.S. Army Natick Soldier Center
ATTN: AMSSB-RTP-W(N)
Kansas St.
Natick, MA 01760-5056

All proposals and administrative inquiries should be submitted to:

Ms. Heather Parker
U.S. Army Natick Soldier Center
ATTN: SSCNC-I-BAA
Kansas Street
Natick, MA 01760
Tel: (508) 233-4929
Email: heather.parker@natick.army.mil

13. **Warrior Performance.** Warrior Performance is the degree to which a warfighter's skills and abilities are implemented for a particular task or set of tasks. It is specific to the military operational

environment. There are on-going efforts to generate data in the area of human factors as it relates to Warrior Performance, however, most of these efforts relate to the physical aspects of performance. Though significant work is being done through these efforts more work remains in order to gain a complete picture of the relationship of the warrior to his/her environment. Concentration on the cognitive aspects of individual warrior performance is lagging. Significant work still remains to be done in this area as well. The objective of this area of study is to generate methodologies as well as relevant data that can be applied directly to the development of emerging warrior systems with equal emphasis on physical and cognitive performance and can be utilized by emerging behavioral models for the same purpose. The warrior performance target audience includes male and female: Dismounted Infantry, Mounted Infantry, Engineers, SOF, Medics, Army Aircrew and Military Police.

Scientific and Technical Areas of Interest.

Development and validation of quantitative measures and criteria as well as methodologies for evaluating these areas is a key element of any proposed effort.

a. Research to determine the performance of individuals and small units with respect to their Situation Awareness. Influencing factors for investigation should include, but not be limited to, maturity, skill, experience, motivation, risk acceptance, training and learned versus inherent propensity for situation awareness. Studies may also include the impact of mission (e.g., complexity, type, intensity), mission environment (e.g., MOUT, Jungle) training proficiency and unit dispersion on the SA of individuals and small units. Studies on the impact of different technology types on situation awareness, and situation awareness and the 'small unit dynamic' are also of interest.

b. Studies on the effect of fatigue on warriors to include, but not be limited to, the influence of mission on physical and cognitive fatigue, quantification of the physical/cognitive relationship of fatigue, quantification of different types of fatigue (e.g., muscle, cognitive, systemic) and their impact on warrior performance, determining mitigating factors of fatigue related to training and determining whether levels/degrees of fatigue be can predicted based on personal characteristics.

c. Research to determine differences in warrior performance due to varying missions (e.g., attack, raid, SASO) and mission environments (e.g., Desert, Arctic). This research should highlight the impact on physical and cognitive warrior performance.

d. Taxonomy – Develop taxonomy of measures and associated criteria of physical and cognitive warrior performance.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC: Ms. Cynthia L. Blackwell, Tel: (508) 233-5210, cynthia.blackwell@natick.army.mil

All concept papers should be submitted to:

Ms. Cynthia L. Blackwell, Tel: (508) 233-5210

Email: cynthia.blackwell@natick.army.mil
U.S. Army SBCCOM-Natick Soldier Center
ATTN: AMSSB-RTP-W(N)
100 Kansas Street
Natick, MA 01760-5056

All proposals and administrative inquiries should be submitted to:
Ms. Heather Parker
U.S. Army Natick Soldier Center
ATTN: SSCNC-I-BAA
100 Kansas Street
Natick, MA 01760
Tel: (508) 233-4929
Email: heather.parker@natick.army.mil

E. TENTAGE, FABRIC STRUCTURES AND RIGID WALL SHELTERS.

The objective is to enhance the protection and capability provided to warfighters and warfighter systems that use soft, rigid wall, and hybrid shelters. Threats include combat and the environment, and capabilities include mobility, transportability, durability and producibility. Research and development enhancements are grouped into seven primary thrusts areas. These are: 1) Ballistic Protection; 2) Chemical/Biological Protection; 3) Electromagnetic Interference/Electromagnetic Pulse Protection; 4) Environmental Protection; 5) Detection Avoidance; 6) Deployment/Durability; and 7) Functional Integration of Multiple Technologies.

Scientific and Technical Areas of Interest:

The following examples (though not inclusive) represent areas of science and technology that are relevant to the objectives of the Tentage and Rigid Wall Shelters area and may be of interest to the Army.

- a. Lightweight rigid shelter panels and/or structures effective against ballistic threats including ceramic/epoxy/fiberglass composite panels with capability of localized/variable protection; applying protection only where critically needed and to the level needed.
- b. High strength, lightweight, flexible, and affordable ballistic resistant fibers, fabrics, or fabric composites for tentage (flexible, thin, abrasion resistant).
- c. Flame retardant fibers and fabrics that maintain mechanical strength, wear, and weather resistance for materials used for tentage applications.

- d. High permeability and high conductivity structural composites that provide EMI/EMP shielding.
- e. Bonding techniques that guarantee long-lasting shielding continuity and integrity at seams and cutouts of rigid wall shelters.
- f. Materials for chemically/biologically protected shelters that are low cost, producible, and able to be easily fabricated into end items.
- g. Variable permeability, smart materials for intelligent response to chemical attack that possess the desirable qualities of a breathable fabric skin and the protection from chemical/biological infiltration afforded by impermeable materials.
- h. Structural closures for chemically/biologically protected shelters; Closures forming cross sections that can be used to produce air tight seals with another similar closure on mating walls while maintaining structural integrity.
- i. Lightweight, low-cost, shelter treatments that reduce visual, IR and radar signatures.
- j. Insulative shelter panel shielding technologies that minimize the acoustic and thermal signatures associated with on-board power generators.
- k. Low bulk and low cube insulative liners for tentage that may utilize active methods of membrane dispersion to produce dead air space and high insulation.
- l. Superinsulative panels for rigid wall shelters using technologies such as high vacuum sandwich panels.
- m. Novel stitching and joining techniques for leak-free seams in tents through the possible use of durable, composite threads that permanently expand with application of a stimulus (e.g. heat) to eliminate the possibility of tent seam leakage due to needle holes, as well as increase seam strength.
- n. Net-shape manufacturing processes for fabric structures utilizing tubular materials with integral end close-outs that form the final shape of a fabric structure without seams except for doors and windows.
- o. Wide (100+ ft), quickly-erected high pressure airbeams for shelters capable of housing all rotary wing aircraft, and many fighter and stealth aircraft. Challenges include optimized airbeam fiber composition and orientation to increase performance and durability, specifically abrasion resistance and flexibility; development of a process capable of fabricating up to 36" dia beams, 150' long; development of rapid airbeam inflation systems; and technologies for long term deployment of airbeam structures, such as alternative inflation substances, and rigidifying.

p. Technology related to large water beams, either single[30' dia x 1000'long] or multiple beams that can be structurally tied together to the aforementioned dimensions in support of a Rapidly Installed Breakwater System [RIBS] capable of withstanding 1 million foot pounds of energy resulting from a sea state 3 condition.

q. Pultruded lightweight, low-cost, thin, width up to 8 feet, composite panels for expandable rigid wall shelters. Highly expandable rigid wall structures that use pultruded panels, with expansion ratio of 12 or higher.

r. Self-erecting tents and shelters utilizing novel technologies such as shape memory materials and phase change materials.

s. Integration of multiple shelter technologies (ballistic/detection avoidance/EMI/EMP/CB) to demonstrate a highly-protected "operate-on-the-move" command post.

t. Integration of multiple shelter technologies to demonstrate a shelter complex that provides multiple survivability capability integral with the system's components, along with rapid deployment through low weight, high expansion, and airbeam support.

u. Modeling of nonlinear fabric structures, fabric/yarn mechanics, constitutive relation, wind structure interactive modeling, and failure criteria.

v. Functional treatments of tentage fabrics that produce reduced effects from solar loading, the capability to accept camouflage printing, and the capability to accept insecticides, etc.

w. Technologies that improve shelter soil/structural interfaces in world-wide environments to include soil stabilization and improved anchoring techniques.

x. Soft wall shelters that become rigid with application of external stimulus, using reversible rigidizing polymers.

Some of the technical approaches for topics within this solicitation may be subject to export control restrictions under existing export control laws, and or required to be conducted as classified projects as outlined in the National Industrial Security Program Operating Manual (NISPOM) and its supplements. Contractors who would like to submit proposals pertaining to such technologies are encouraged to contact their local Defense Investigative Service (DIS) Industrial Security representative or have the Technical POC listed in the solicitation for guidance.

Communication with the Technical POC's prior to submission of a formal proposal is essential.

Technical POC's:

Ms. Jean Hampel, Tel: (508) 233-4692, jean.hampel@natick.army.mil

Mr. William Nykvist, Tel: (508) 233-4290, bill.nykvist@natick.army.mil

Contract Data Rqmts POC:

Ms. Arlene Garwood, Tel: (508) 233-5338, arlene.garwood@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Center

ATTN: AMSSB-RCP(N) (Ms. Arlene Garwood)

Natick, MA 01760

(508) 233-5338, arlene.garwood@natick.army.mil

F. AIRDROP - ADVANCED PERSONNEL AND CARGO AIRDROP SYSTEMS.

Airborne force projection and aerial delivery methods are critical operational capabilities of the military's strategic shift toward a CONUS-based force. Increasing mission responsibilities now include humanitarian missions. Airdrop science and technology is focused on: 1) increasing aircraft/airborne force survivability in a threat environment by expanding the airdrop operational envelope; 2) improving airdrop accuracy through the introduction of standoff (of various levels) precision guided aerial delivery platforms and low level airdrop systems; 3) reducing personnel injuries/casualties by improving system functional reliability while reducing ground impact velocity, oscillation, and exposure time to threats; 4) reducing the cost and time required for parachute development and production by using novel new parachute designs developed by computational analytical methods to reduce manufacturing and testing requirements; and 5) improving airdrop survivability of shock sensitive payloads and enhancing battlefield effectiveness through the use of soft landing and roll-on/roll-off technologies to reduce drop zone derigging times.

Scientific and Technical Areas of Interest:

An assessment of current personnel and cargo airdrop capabilities and ongoing research and development efforts versus future requirements has led to the following areas of interest:

a. Cargo airdrop technologies should focus on precision aerial delivery for heavy cargos and long range off-set distances, including high glide and extended off-set powered systems. Affordable high altitude precision delivery systems and low cost guidance, navigation and control (GN&C) systems are also desired with compatible mission planning systems at various levels of integration with delivery platforms. Advanced concepts for soft landing of heavy loads to provide rapid roll-on/roll-off capability are needed.

b. New personnel parachute systems are needed to provide accurate delivery as well as low velocity landings coupled with ground wind attenuation to minimize body injuries. High glide and high

off-set distance canopy designs, along with high tech communication, video, and global positioning systems are needed for steerable personnel parachute systems.

c. Advanced construction methods for low cost manufacture of ram-air gliding wings, round, cross and other parachute systems.

d. Development of embedded advanced sensors and measurement technology to investigate the structural dynamics and motion of canopy fabrics during parachute inflation. Investigation of smart parachute fabrics to improve parachute performance, e.g. variable porosity canopy fabric.

e. Modeling and experimental research on the unsteady aerodynamics of parachute inflation, and its interaction with the external flow field, such as a vortex from an aircraft.

f. Computer modeling and experimental investigation of the biomechanics of paratroopers during parachute deployment/inflation and their landings.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Richard Benney, Tel: (508) 233-5835, richard.benney@natick.army.mil

Dr. Calvin Lee, Tel: (508) 233-4267, calvin.lee@natick.army.mil

Contract Data Rqmts POC:

Ms. Allison Griffin, Tel: (508) 233-4495, allison.griffin@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Center

ATTN: AMSSB-RAD(N)-BAA (Ms. Kimberly Mahon)

Natick, MA 01760

(508) 233-4345, kimberly.mahon@natick.army.mil

G. TEXTILE TECHNOLOGIES.

Textile technology programs relate to protection of the individual soldier against battlefield threats such as ballistic, soldier detection, chemical, biological, fire, thermal and directed energy, while ensuring survival under extremes of environmental (temperature and humidity) conditions by involving comprehensive research and engineering. In addition to threat survivability, there is a strong interest in the new and growing field of “wearables.” The wearables field is of interest insofar as it relates to the integration of electronic capabilities in to textile materials, combat clothing and combat field equipment

worn by Warfighters. The following is a summary list of textile technologies of interest to the Natick Soldier Center:

- a. Polymer synthesis and characterization
- b. Fiber morphology and mechanical property characterization
- c. High-strength fibers, i.e., fibers from liquid crystal polymers
- d. Yarn and fabric manufacturing and fabric preparation and finishing processes
- e. Photochemistry and photophysics of dyes and dyed textiles
- f. Methods for sorbing/reacting chemical warfare agents in lightweight, low-heat stress textile systems.
- g. Producibility of unique fibers and fabrics
- h. Thermally resistant insulating textile systems
- i. New technologies for the characterization of textile systems properties (e.g. electrostatic, electromagnetic, durability; and flame, thermal and ballistic resistance).
- j. Consideration of comfort and physiological implications of protective clothing.
- k. Polymer batteries and lightweight sources of power.
- l. Power junctures and connections integrated in to textiles for access and supply of power to electronic components.
- m. Connections for power and data wires to electronic components and sensors.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Maurice Larrivee, Tel: (508) 233-4447, maurice.larrivee@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Natick Soldier Center

ATTN AMSSB-RIP(N)/Ms. Heather Parker Natick, MA 01760

(508) 233-4929, heather.parker@natick.army.mil

H. MODELING AND SIMULATION.

1. *Individual and Small Unit Performance and Survivability.* Ballistic, chemical, and environmental casualty assessment models plus unit performance models have been used to show the relative benefit of one proposed protective clothing ensemble design versus another. Initial work has been accomplished to support the integrated analytic simulation of individuals and small units to assess their potential survival and performance when equipped with current or proposed individual combatant clothing and equipment ensembles. Work has been accomplished to link this integrated analytic environment to other analytic and training simulations using both Distributed Interactive Simulation (DIS) protocols (IEEE Standard 1278.1) and DoD High Level Architecture (HLA) approaches. The resulting integrated analytic simulation environment is the Integrated Unit Simulation System (IUSS). The IUSS currently provides simulation of various casualty mechanisms from ballistic, chemical, and environmental hazards as well as providing simulation of individual and small unit movement and combat.

Scientific and Technical Areas of Interest:

A review of the existing models and simulations has revealed the following areas of continuing scientific and technical interest:

- a. Development of a methodology and faster than real time model to simulate the effects of battlefield stresses, such as physical exertion, sleep deprivation and heat stress on the various types of fatigue and ultimately on infantry task performance.
- b. Development of a methodology and faster than real time model to simulate the target detection, recognition, identification and acquisition process under various lighting and operational conditions.
- c. Development of a real time, 3 dimensional, DIS/Higher Level Architecture (HLA) compatible Windows 95/NT based synthetic visual and audio environment.
- d. Development of a methodology and faster than real time model to simulate inter-human communication to include voice, radio, visual, and written display.
- e. Enhance the IUSS and associated supporting models to support automated communications with other standard U. S. Army and NATO analytic simulations and war games such as JANUS, JCATS, CASTFOREM and CAEN.
- f. Enhancement of the IUSS and associated supporting models to allow user to parametrically analyze capability requirements and accomplish the full range of virtual prototyping and testing of individual clothing, equipment, and weapons.
- g. Technological assets which would result in a full Soldier Systems Integration Laboratory capability, that would allow full assessment of fightability under controlled laboratory situations.

h. Tools and capabilities, especially in the studies and analysis area, that allow us to provide the technical support to the programs in counter terrorism, domestic preparedness, and contingency management (enhance) – the same tools that allow us to assess contingencies in missions ranging from peacekeeping to peacemaking to combat.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Roger A. Schleper, Tel: (508) 233-4881 roger.schleper@natick.army.mil

All concept papers, proposals and administrative inquiries should be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSSB-RSS(N) (Ms. Gail Bernheart)
Natick, MA 01760-5020
(508) 233-4706 gail.bernheart@natick.army.mil

2. *Airdrop System Combat Worth Simulation.* If airdrop delivery of various payloads can be simulated in a realistic environment, then the combat worth of prototype airdrop systems can be addressed early in the R&D cycle. Simulation will also allow for the assessment of risk that is associated with various mission and threat profiles, as well as the evaluation of various airdrop system attributes. This information will be useful in assessing the combat worth of a system, determining system design points, and determining methods of most effectively employing various airdrop systems. Limited simulations incorporating airdrop systems and their delivery aircraft into two existing TRADOC Analysis Center scenarios has been accomplished using Extended Air Defense Simulation (EADSIM). This analysis has answered many basic questions pertaining to the vulnerability of airdrop systems.

Scientific and Technical Areas of Interest:

Current efforts are focusing on inserting airdrop systems into two scenarios using Distributive Interactive Simulations (DIS) to link air and ground combat models to look at a wider range of issues concerning the combat contributions of potential aerial delivery systems. Natick has interest pertaining to modeling and simulation of airdrop systems in the following areas:

a. The continued development of the M&S infrastructure and / or tool development as pertains to airdrop systems. Example tasks could include the development of High Level Architecture (HLA) DIS compliant analytic drivers for generalized virtual airdrop systems, adaptation of existing combat simulation models to allow for accurate representation of airdrop systems and development of visual models of airdrop systems for use in DIS 3D viewers.

b. The conduct of analysis to assess various issues related to the combat worth of airdrop systems. Issues include but are not limited to system vulnerability, impact upon logistics and unit mobility, impact on war fighting capability and determining effective methods of using next generation airdrop systems

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Robert Auer, Tel: (508) 233-5529 robert.auer@natick.army.mil

All concept papers, proposals and administrative inquiries shall be submitted to:

U.S. Army Soldier Systems Center
Natick Soldier Center
ATTN: AMSSB-RSS(N) (Ms. Gail Bernheart)
Natick, MA 01760-5020
(508) 233-4706 gail.bernheart@natick.army.mil

3. ***Analytic 3D Soldier System Prototyping and Testing.*** Modeling and simulation are becoming an increasingly important part of systems design, development, and operation. This is especially true in the case of systems where physical prototyping and assessment through human use is too dangerous or expensive, as is the case with personal-protective systems. Models and simulations which support computer aided design, virtual prototyping, and operational test and evaluation, are valuable tools for decreasing life-cycle costs and optimizing systems' utility and effectiveness. Unfortunately, at present no integrated human model exists that can:

- Accurately model human surface and tissue,
- Integrate protective gear,
- Assess the effects of mass and inertia,
- Integrate work surroundings,
- Incorporate weapons effects, and
- Estimate injury due to weapons and impact.

All of these features exist to some extent in various models, but nowhere do they come together so that combined and interactive effects are assessable.

Scientific and Technical Areas of Interest:

A review of the existing analytic 3D computer based prototyping and testing applications has revealed the following areas of continuing scientific and technical interest:

a. Development of an automated, integrated, analytic 3 dimensional Soldier System prototyping and testing environment (i.e., suite of analysis tools) which incorporates the best available models of ballistic

penetration, blunt trauma, toxicology, fatigue, anthropometric and biomechanic aspects, and dehydration in realistic battlefield settings with simulations of mitigating materiel approaches.

b. Verification and validation of the developed automated, integrated, analytic 3 dimensional Soldier System prototyping and testing environment using actual data.

Estimated total level of effort is five man years for a period of at least three years.

Communication with the Technical POC prior to submission of a formal proposal is essential.

Technical POC:

Mr. Roger A. Schleper, Tel: 508-233-4881, roger.schleper@natick.army.mil

Safety POC:

Mr. Paul Angelis, Tel: 508-233-5208, paul.angelis@natick.army.mil

MANPRINT POC:

Ms. Rose Guerra, Tel: 508-233-4070, rose.guerra@natick.army.mil

All concept papers, proposals and administrative inquiries shall be submitted to:

U.S. Army Soldier Systems Center

Natick Soldier Center

ATTN: AMSSB-RSS(N) (Ms. Gail Bernheart)

Natick, MA 01760-5020

(508) 233-4706, gail.bernheart@natick.army.mil

I. BIOSYSTEMS TECHNOLOGY PROGRAM RESEARCH AND DEVELOPMENT.

Biosystems Technology Program (BTP) ideas and proposals are sought that are applicable to products unique to Hawaii or directed at resolving Hawaiian or subtropical issues through the utilization/implementation of innovative technology. The Program is a congressional “earmark” effort that is administered under the auspices of USDA and DoD.

Under the BTP, the focus is to develop, demonstrate, and commercialize or integrate into military systems environmentally conserving technologies or products to competitively meet the demands of the military and civilian sectors. Specifically the program is dedicated to the responsible use of the diverse plants and microorganisms found only in tropical and subtropical regions to develop food, fiber, and other products and services and finally to apply these technologies/services to satisfying the civilian and military markets. In part, these activities will enable the Department of Defense to comply with Executive Order 13101, use of recycled and environmentally preferable products. These activities are

consistent with the Master Memorandum of Understanding between the Departments of Defense and Agriculture and further contribute to community support activities in areas with a substantial military presence. To the extent practical, the Biosystems Technology Program is directed at filling the gap between promising laboratory projects/results and full-scale commercialization.

Collaborative efforts are strongly encouraged in the BTP. Generally the priority areas are but are not restricted to the following:

- (a) Antioxidants
- (b) Anti-microbials/Biocides
- (c) Food and Nutrition (to include innovative delivery systems)
- (d) Pest Management
- (e) Restoration of Contaminated Resources via agricultural mechanisms/technologies

The BTP is a joint collaboration between the Department of Defense and USDA and it is envisioned that commercial companies and academia will interact in the BTP.

Technical POC for the Biosystems Technology Program:

Ms. Betty A. Davis, Tel: (508) 233-4509, betty.davis@natick.army.mil

All concept papers, proposals, and inquiries for the Biosystems Technology Program should be submitted to:

U.S. Army Soldier Biological and Chemical Command
Natick Soldier Center
ATTN: AMSSB-RCF-P (N)
Building #36
Room E-112
Natick, MA 01760
betty.davis@natick.army.mil